Improved lensing reconstruction with a non-parametric code

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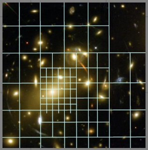
- we integrate physical priors in the code: contribution to the deflection field coming from the galaxies of the cluster.
- new code is tested with simulated data (strong lensing) that mimics real data
- It greatly help to increase the resolution of the solution and reduce the uncertainties.

SLAP code (Diego et al. 2005)

- Non-parametric code:



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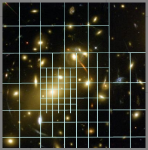

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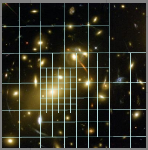

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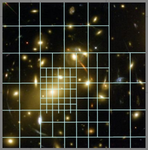

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  - **The problem:** a linear system of $2N_\theta$ equations and $(2N_S + N_C)$ unknowns:

$$\mathbf{\Theta} = \mathbf{\Gamma x} \rightarrow \begin{bmatrix} \theta_x \\ \theta_y \end{bmatrix} = \begin{bmatrix} \mathbf{\Upsilon}_x & \mathbf{I}_x & \mathbf{0} \\ \mathbf{\Upsilon}_y & \mathbf{0} & \mathbf{I}_y \end{bmatrix} \times \begin{bmatrix} \mathbf{c} \\ \beta_x \\ \beta_y \end{bmatrix}$$

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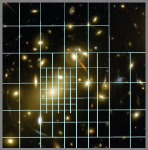

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- Approximate solution $\rightarrow$ residual equation: $\mathbf{r} \equiv \mathbf{\Theta} - \mathbf{\Gamma x}$.

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$\rightarrow$ We will use these tool to obtain the deflection field of the cluster galaxies.

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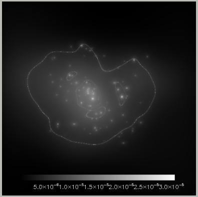
- New column in Γ matrix given by α_{gal}.
- New unknown, c_{gal}, proportionality constant.
- **New system of equations:**

$$\begin{bmatrix} \theta_x \\ \theta_y \end{bmatrix} = \begin{bmatrix} \Upsilon_x & \alpha_{gal,x} & \mathbf{I}_x & \mathbf{0} \\ \Upsilon_y & \alpha_{gal,y} & \mathbf{0} & \mathbf{I}_y \end{bmatrix} \times \begin{bmatrix} \mathbf{c} \\ c_{gal} \\ \beta_x \\ \beta_y \end{bmatrix}$$

Results

Recomposed critical curves



Simulated cluster

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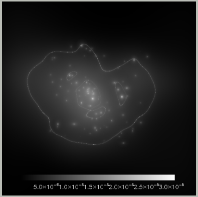

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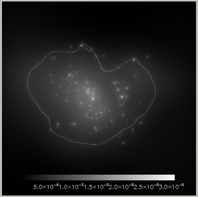

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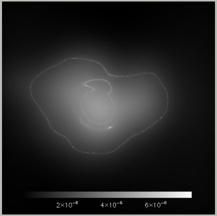

SLAP old version

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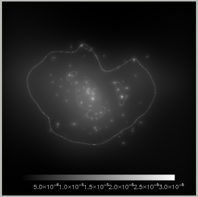

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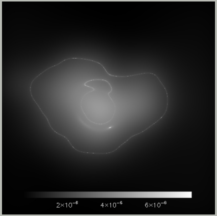

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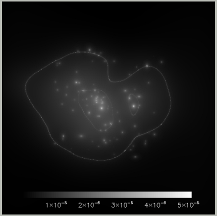

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Recomposed mass profile

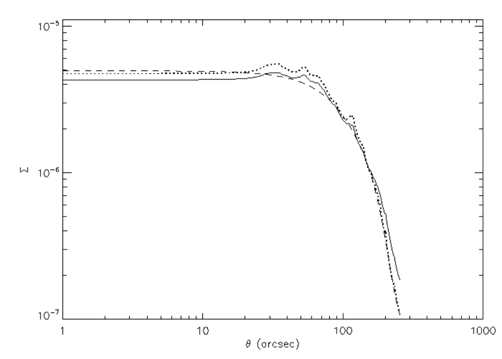

Figure: **Thick lines** → real/simulated case, **dotted lines** → new version of SLAP. and **dashed lines** → old version of SLAP

Conclusions

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- **Next step:** Apply this new version of the code to real clusters.
- **This new version of the code based in a non-parametric approach will also provide an important consistency check for the parametric approach, since concurring results will strengthen their validity, whereas any resulting differences would need to be addressed.**